QUALITY ASSURANCE PROJECT PLAN – REVISION 1

CORNELL-DUBILIER ELECTRONICS SUPERFUND SITE
OPERABLE UNIT 2 – BUILDING DEMOLITION
SOUTH PLAINFIELD, NEW JERSEY

CLUSTER 12

CONTRACT # W912DQ-04-D-0023
DELIVERY ORDER #0005

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APPENDICES

List of Abbreviations and Acronyms

COC	Chain of Custody
CQCSM	Contractor Quality Control Systems Manager
DNF	Deficiency Notification Form
DOD	Department of Defense
DQO	Data Quality Objective
FSP	Field Sampling Plan
ICP	Inductively Coupled Plasma
IDL	Instrument Detection Limit
LCS	Laboratory Control Samples
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NCR	Non-Conformance Report
NELAP	National Environmental Laboratory Accreditation Program
NJDEP	New Jersey Department of Environmental Protection
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	Polychlorinated Biphenyls
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC Plan	*Analytical Laboratory Quality Assurance and Quality Control Plan* (WST, 2004)
QC	Quality Control
QCSR	Quality Control Summary Report
QSM	*Quality Systems Manual for Environmental Laboratories* (DOD, 2006)
RDCSCC	Residential Direct Contact Soil Cleanup Criteria
RF	Response Factor
RPD	Relevant Percent Difference
SAP	Sampling and Analysis Plan
Sevenson	Sevenson Environmental Services, Inc.
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
WST	Waste Stream Technology, Inc.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Sevenson Environmental Services, Inc. (Sevenson) is the designated USACE contractor responsible for conducting the activities required by the current task order. The functional responsibilities of key personnel are described in the following parts of this section. The assignment of personnel to each project position will be based on a combination of (1) experience in the type of work to be performed, (2) experience working with USACE personnel and procedures, (3) a demonstrated commitment to high quality and timely job performance, and (4) staff availability.

2.1 Subcontracted Laboratory Support

Analytical laboratory support specific to Site sampling activities will be obtained from Waste Stream Technology, Inc. (WST) of Buffalo, New York. WST holds current New Jersey Department of Environmental Protection (NJDEP), National Environmental Laboratory Accreditation Program (NELAP), and USACE certification for the parameters of interest at the Site. WST will perform laboratory activities in accordance with the requirements of the Department of Defense (DOD) *Quality Systems Manual (QSM) for Environmental Laboratories* (DOD, 2006). WST's *Analytical Laboratory Quality Assurance and Quality Control Plan, Revision 12* (QA/QC Plan; WST, 2004) is included in Appendix B.

An organizational chart outlining key laboratory personnel and organization is included in the laboratory QA/QC Plan (Appendix B). Prior to the commencement of field activities for the project, a complete copy of the SAP, including this QAPP, will be sent to the laboratory. The responsibilities of key personnel are described in the following sections.

2.1.1 Laboratory Quality Assurance/Quality Control Manager

The QA/QC Officer for WST is Mr. Dan Vollmer. As the Laboratory QA/QC Manager, Mr. Vollmer is responsible for the laboratory QA/QC in accordance with the requirements of this QAPP in conjunction with the established laboratory QA Program. In coordination with the Project Laboratory Coordinator, Mr. Vollmer will be responsible for:

- Documenting that samples received by the laboratory are analyzed in accordance with required methodologies.
- Assuring that instrument calibration is performed properly and documented.
- Verifying that field and internal laboratory QC samples are analyzed and documented.
- Reporting both field and QC samples in the format required by the laboratory scope of work and the QAPP.
- Processing laboratory nonconformance reports (NCRs) and laboratory/analytical deficiency notification forms (DNF) in a timely manner.
- Implementing Corrective Action Report recommendations and requirements.

2.1.2 Laboratory Project Manager

Mr. Vollmer will also serve as the laboratory Project Manager for this project. The responsibilities of the laboratory Project Manager include the following:

- Initiation and maintenance of contact with the project on individual job tasks.
- Preparation of all laboratory-associated work plans, schedules, and manpower allocations.
- Initiation of laboratory associated procurement for the project.
- Provision of day-to-day direction of the laboratory project team including analytical department managers, supervisors, QA personnel, and data management personnel.
- Coordination of all laboratory related financial and contractual aspects of the project.
- Provision of formatting and technical review for all laboratory reports.
- Provision of final review and approval on all laboratory analytical reports to the project.
- Response to all post project inquiries.

2.1.3 Laboratory Manager

Dr. Brian Schepart is the WST Laboratory Manager. The responsibilities of the Laboratory Manager include the following:

- Coordination with all analytical production activities conducted within the analytical departments.
- Working with the Laboratory Project Manager to ensure all project objectives are met.

- Provision of guidance to analytical department managers.
- Facilitation of transfer of data produced by the analytical departments to the report preparation and review staff for final delivery to the client.

2.1.4 Laboratory Section Heads, Department Managers, and Technical Leads

The responsibilities of each laboratory section or department include the following:

- Coordination of all analytical functions related to specific analytical areas.
- Provision of technical information to and oversight of all analysis being performed.
- Review and approve all analytical results produced by their specific analytical area of expertise.
- Maintenance of all analytical records and information pertaining to the analysis being performed.

Analytical professionals exhibiting the qualifications defined in Section 6.0 of the DOD QSM (DOD, 2006) shall staff the laboratory.

2.2 Contact Information

Points of contact for personnel for Sevenson and WST are provided in Table 2-1 of the FSP. If it should become necessary at any time throughout the duration of this project to make any changes/additions to staff personnel, Sevenson will notify the USACE Contracting Officer or a Designated Representative prior to such changes and/or additions. In addition, the WST contact person will be notified if any of these personnel changes directly affect whom to contact for sample receipt problems, data reporting problems, guidance, and decision authority.

2.3 Personnel Qualification Requirements

Personnel performing the tasks and having the responsibilities identified under Section 2.0 shall have and maintain the qualifications as specified in the USACE contract documents, including ER 1110-1-263 (June 1993) and Section 5.2 of the QSM (DOD, 2006). Personnel operating specific equipment, performing environmental tests, evaluating results, and signing analytical reports shall be qualified on the basis of appropriate education, training, experience, and/or demonstrated skills, as required. Laboratory technical staff

will have the education and experience to demonstrate knowledge of their particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management. New employees will be certified through the analysis of laboratory quality control samples (i.e., initial demonstration of performance studies) prior to being allowed to analyze project samples. The Sevenson Project Manager will maintain a record of requirements, training, and qualifications for each individual.

3.0 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements that specify the quality of data required to support decisions made during remedial response activities and are based on the end use of the data being collected. To determine the project DQOs, a series of planning steps are used, as specified in the USEPA *Guidance for Data Quality Objectives Process* (USEPA, 1994) to identify the data needed to support project decisions and develop a data collection program. The process is intended to optimize data collection and meet the applicable decision criteria. The seven steps are detailed below.

STEP 1: STATE THE PROBLEM. The Cornell-Dubilier Superfund Site facility buildings may contain materials which may be regulated when disposed of. Debris, soil, concrete, and water need to be characterized to determine what materials require disposal as hazardous wastes and as regulated non-hazardous waste. In addition, backfill and topsoil materials brought onsite for restoration activities will have to be shown to be below the NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC).

STEP 2: IDENTIFY THE DECISION. To meet the objectives, the following decisions will need to be made during the remedial action:

- Determine whether or not there is any risk by assuming materials are either hazardous or non-hazardous for disposal.
- Determine whether offsite source materials pose a risk to human health or the environment prior to bringing such materials to the site.

STEP 3: IDENTIFY THE INPUTS TO THE DECISION. The following inputs are required to answer the questions identified in Step 2:

- Review the existing data for building materials, including information from field visits, common construction practices, building construction dates, contamination sources, and site history.
- Collect additional samples needed to confirm existing data in order to establish disposal requirements.
- Determine appropriate analytical methods, regulations, and action levels.

STEP 4: DEFINE THE STUDY BOUNDARIES. The physical boundaries of the remedial action are the perimeters of each of the facility buildings and associated structures. All facility buildings are located within the site boundaries.

STEP 5: DEVELOP A DECISION RULE. The purpose of this step is to integrate the outputs from the previous steps that define the conditions that would cause the decision-maker to close among alternative actions. The following primary decision rules will be used to answer the fundamental questions:

- For building demolition, if the maximum concentration for each sample at each homogeneous location for each parameter tested is below the regulatory action levels, then disposal of the homogeneous building material would not be concern.
- For backfill and topsoil, if the maximum concentration for each sample for each parameter tested is below the acceptance criteria, then the material may be used at the site and be considered not a hazard to human health or the environment.

STEP 6: SPECIFY LIMITS ON DECISION ERRORS. This step is to specify the decision-maker's acceptable limits on decision errors, which are used to establish appropriate performance goals for limiting uncertainty in environmental data. These acceptable limits on decision errors allow decision-makers to generate resource-effective sampling designs while limiting uncertainties in the collected data.

There are two types of decision errors applicable to estimating the true value of a population: (1) sampling design error, which occurs when the sampling design is unable to capture the complete state of natural variability over space and time, and (2) measurement error, which refers to a combination of random and systematic errors, known as the total error, can be controlled by hypothesis testing; that is, selecting the null hypothesis (H_o) and the alternative hypothesis (H_a) and testing to reject or accept H_o. The null hypothesis is the baseline condition that is presumed to be true in the absence of strong evidence to the contrary.

The null hypothesis and alternative hypothesis for demolition debris disposal are as follows:

- H_o: Demolition debris does not contain constituents which are regulated when disposed of when the buildings and structures are demolished.

- H_a: Building debris does contain constituents which are regulated when disposed of when the buildings and structures are demolished.

The null hypothesis and alternative hypothesis for backfill and topsoil materials are as follows:

- H_o: Backfill and topsoil do not contain constituents which are greater than the NJDEP RDCSCC.
- H_a: Backfill and topsoil do contain constituents which are greater than the NJDEP RDCSCC.

There are two types of decision errors: (1) the false rejection of the decision error (i.e., false positive), or Type I error, which occurs when the null hypothesis is rejected when it is true, and (2) the false acceptance decision error (i.e., false negative), or Type II error, which occurs when the null hypothesis is not rejected when it is false. In this case, the false rejection error is concluding that the demolition debris do contain constituents which are regulated when disposed of, when the debris actually does not contain such constituents. Likewise, the false rejection error for offsite source material is concluding that backfill and topsoil materials do contain constituents which are greater than the NJDEP RDCSCC, when the materials actually do not contain such constituents. The false acceptance error is concluding that the demolition debris does not contain constituents which are regulated when disposed of, when the debris actually does contain such constituents. Likewise, the false acceptance error for offsite source material is concluding that backfill and topsoil materials do not contain constituents which are greater than the NJDEP RDCSCC, when the materials actually do contain such constituents.

The consequence of the false rejection decision error will be the unnecessary expenditure of resources. The consequence of the false acceptance error is that the demolition debris and offsite source materials pose risk to human health or the environment. Because of the possible severity of the false acceptance decision error consequence, the false rejection error is more tolerable than the false acceptance decision error. The former will occur when the analytical results are biased high and the latter will occur when the analytical results are biased low.

STEP 7: OPTIMIZE THE DESIGN. This step involves identifying the most resource-effective sampling and analysis design for generating data that are expected to satisfy project DQO.

The consequence of the decision error will need to be balanced against the cost of limiting the possibility of these errors. These errors will be managed by the use of precise and accurate analytical methods and a relatively large number of samples along with duplicate samples. The large number of samples will need to be collected to minimize the false acceptance decision, and to minimize risk. The approach to overcome the large number of samples is to limit the number of samples for homogeneous materials and of materials that are known to contain constituents of concern. The approach to overcome the risk is to systematically perform sampling, even in areas where constituents of concern are not expected to be present.

The sampling design will consist of judgmental sampling backed up with simple random sampling. In the judgmental sampling methodology, the sampling locations are based on data from previous investigations of the site. Typically, this is useful to confirm the existence of contamination at specific locations, based on historical sampling results. To confirm areas that are not suspected to contain constituents of concern, a simple random sampling methodology will be performed in those areas. With simple random sampling, all areas that are not suspected of containing contaminants of concern have an equal probability of being selected and each sampling point is selected independently from all other sample points.

3.1 Data Quality Levels

Samples of Site media will be obtained and contaminant constituent parameters will be measured to generate data that supports Site data use requirements. Definitive data quality is anticipated for this project. A summary of data quality levels by sample type is included in Table 3-1.

A definitive level of data quality indicates that the analytical test will be performed by an offsite laboratory using instrumentation capable of giving a quantifiable data result. Data generated at this level is subject to quality assurance and control procedures that include the collection and analysis of QA/QC samples. Definitive quality data shall be acquired, documented, verified, and reported to ensure that the specified precision, accuracy, representativeness, comparability, completeness, and sensitivity requirements are met.

TABLE 3-1: DATA QUALITY LEVELS FOR CHEMICAL PARAMETERS

CHEMICAL PARAMETER	ANALYTICAL METHOD	DQO LEVEL
Toxicity Characteristic Leachate Procedure (TCLP) VOCs (solid and aqueous)	SW-846 Method 1311/5030C/8260B	Definitive
TCLP SVOCs (solid and aqueous)	SW-846 Method 1311/3510C/8270C	Definitive
TCLP Pesticides (solid and aqueous)	SW-846 Method 1311/3510C/8081A	Definitive
TCLP Herbicides (solid and aqueous)	SW-846 Method 1311/3510C/8151A	Definitive
TCLP Metals (solid and aqueous)	SW-846 Method 1311/3015/6010B/7470A	Definitive
Ignitability (solid and aqueous)	SW-846 Method 1010	Definitive
Corrosivity (solid and aqueous)	SW-846 Method 9045C/9040C	Definitive
Reactive Cyanide (solid and aqueous)	SW-846 Section 7.4.3.2, Method 9014	Definitive
Reactive Sulfide (solid and aqueous)	SW-846 Section 7.4.4.2, Method 9034	Definitive
Target Compound List (TCL) VOCs (solid)	SW-846 Method 5030/8260B	Definitive
TCL SVOCs (solid)	SW-846 Method 3550C/8270C	Definitive
TCL Pesticides (solid)	SW-846 Method 3550C/8081A	Definitive
Total PCBs (solid, aqueous, and wipe)	SW-846 Method 3550C/8082	Definitive
Target Analyte List (TAL) Metals (solid)	SW-846 Method 3050/6010B/7471A	Definitive

3.2 Quality Assurance Program

All subcontracted analytical laboratories will have a written QA program that provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA program is coordinated and monitored by the laboratory's QA department, which is independent of the operating departments. For these investigations, the selected support laboratory QA/QC Plan will be referenced and implemented in its entirety. In the field, a QA manager who is independent of the filed team has been assigned to the project.

The stated objectives of the laboratory QA program are to:

- Ensure that samples were properly preserved in the field, as necessary.
- Properly store all samples upon receipt from the field.

- Maintain adequate custody records from sample collection through reporting and archiving of results.
- Use properly trained analysts to analyze all samples by approved methods within holding times.
- Produce defensible data with associated documentation to show that each system was calibrated and operating within precision and accuracy control limits.
- Accurately calculate, check, report, and archive all data using the Laboratory Information Management System (LIMS).
- Document all of the above activities so that all data can be independently validated.

All laboratory procedures are documented in writing as Standard Operating Procedures (SOPs), which are edited and controlled by the laboratory's QA department. Internal QC measures for analysis will be conducted in accordance with their SOPs and the individual method requirements specified.

3.3 QA Objectives for Chemical Data Measurement

DQOs have been developed with reference to the PARCC goals (i.e. precision, accuracy, representativeness, comparability, and completeness), method sensitivity, documentation, data reporting, and data validation. These parameters are defined below.

- **Precision.** Precision is a measure of the degree of the agreement among individual measurements of the same property under similar conditions. Precision measures the random error component of the data collection process. Precision may be affected by the natural variation of the matrix or contamination within the matrix, as well as by errors made in the field and/or laboratory handling procedures. The degree of agreement, expressed as relative percent difference, is calculated using the formula included in Section 8.3.

  Matrix spike (MS) and matrix spike duplicate (MSD) pairs and laboratory duplicate samples are used to assess analytical precision. Field precision is assessed by measurement of field duplicate samples. The objective for laboratory precision is to recover relative percent difference (RPD) values within the established laboratory control limits for each method. The objective for field precision is to recover RPD values between field duplicate samples within the acceptance criteria presented in Table 3-2 for each method. If the RPD acceptance criteria for field duplicate samples are not achieved, field-sampling procedures, including homogenization, will be reviewed with sampling personnel. In

addition, the laboratory will be made aware of the discrepancy such that they may review internal sample preparation and analysis procedures. The laboratory and field precision goals are included in Table 3-2.

- **Accuracy**. Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Accuracy measures the bias or systematic error of the entire data collection process. Sources of these errors include the sampling process, field and laboratory contamination, sample preparation and handling, sample matrix interferences, sample preparation methods, and calibration and analytical procedures. Accuracy is expressed as a percent recovery and is calculated using the formula found in Section 8.2 of this QAPP.

  Analytical accuracy is measured by the analysis of calibration checks, system blanks, quality control samples, surrogate spikes, matrix spikes, and other method-specific checks. Field accuracy is assessed by evaluating the results of field and trip blanks and is maintained by frequent and thorough review of field procedures. The objective for precision is to meet the established laboratory control limits for the methods. The accuracy goals are included in Table 3-2.

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES

Parameters	Precision (Relative Percent Difference)	Accuracy % of Spike Recovery		Field Duplicate RPD Acceptance Criteria
SOIL MATRICES				
TAL Metals		**LCS**	**MS/MSD**	
Aluminum	25	80-120	75-125	40
Antimony	25	80-120	75-125	40
Arsenic	25	80-120	75-125	40
Barium	25	80-120	75-125	40
Beryllium	25	80-120	75-125	40
Cadmium	25	80-120	75-125	40
Calcium	25	80-120	75-125	40
Chromium	25	80-120	75-125	40
Cobalt	25	80-120	75-125	40
Copper	25	80-120	75-125	40
Iron	25	80-120	75-125	40
Lead	25	80-120	75-125	40
Magnesium	25	80-120	75-125	40

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES

Parameters	Precision (Relative Percent Difference)	Accuracy % of Spike Recovery		Field Duplicate RPD Acceptance Criteria
Manganese	25	80-120	75-125	40
Nickel	25	80-120	75-125	40
Potassium	25	80-120	75-125	40
Selenium	25	80-120	75-125	40
Silver	25	80-120	75-125	40
Sodium	25	80-120	75-125	40
Thallium	25	80-120	75-125	40
Vanadium	25	80-120	75-125	40
Zinc	25	80-120	75-125	40
Mercury	25	80-120	75-125	35
TCL VOCs		**LCS**	**MS/MSD**	
1,1,1,2-Tetrachloroethane	25	75-125	60-140	40
1,1,1-Trichloroethane	25	70-135	74-125	40
1,1,2,2-Tetrachloroethane	25	55-130	59-141	40
1,1,2-Trichloroethane	25	60-125	65-136	40
1,1-Dichloroethane	25	75-125	67-131	40
1,1-Dichloroethene	25	65-135	76-125	40
1,2-Dichloroethane	25	70-135	73-128	40
1,2-Dichloropropane	25	70-120	75-119	40
2-Butanone	25	30-160	26-219	40
2-Hexanone	25	45-145	33-184	40
4-Methyl-2-pentanone	25	45-145	32-184	40
Acetone	25	20-160	35-214	40
Acrylonitrile	25	70-130	60-140	40
Benzene	25	75-125	82-118	40
Bromodichloromethane	25	70-130	73-123	40
Bromoform	25	55-135	56-131	40
Bromomethane	25	30-160	17-156	40
Carbon Disulfide	25	45-160	64-116	40
Carbon Tetrachloride	25	65-135	69-118	40
Chlorobenzene	25	75-125	77-124	40
Chloroethane	25	40-155	63-151	40
Chloroform	25	70-125	78-125	40
Chloromethane	25	50-130	39-126	40
cis-1,2-Dichloroethene	25	65-125	75-129	40
cis-1,3-Dichloropropene	25	70-125	67-117	40
Dibromochloromethane	25	65-130	64-138	40

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES				
Parameters	**Precision (Relative Percent Difference)**	**Accuracy % of Spike Recovery**		**Field Duplicate RPD Acceptance Criteria**
Ethylbenzene	25	75-125	79-122	40
m,p-Xylene	25	80-125	78-127	40
Methylene Chloride	25	55-140	22-169	40
o-Xylene	25	75-125	77-128	40
Styrene	25	75-125	48-148	40
Tetrachloroethene	25	65-140	70-128	40
Toluene	25	70-125	72-132	40
trans-1,2-Dichloroethene	25	65-135	80-119	40
trans-1,3-Dichloropropene	25	65-125	68-137	40
Trichloroethene	25	75-125	55-140	40
Vinyl Acetate	25	38-106	10-112	40
Vinyl Chloride	25	60-125	58-144	40
TCL SVOCs		**LCS**	**MS/MSD**	
1,2,4-Trichlorobenzene	35	45-110	43-120	35
1,2-Dichlorobenzene	35	45-95	50-110	35
1,3-Dichlorobenzene	35	40-100	49-109	35
1,4-Dichlorobenzene	35	35-105	47-112	35
2,4,5-Trichlorophenol	35	50-110	49-127	35
2,4,6-Trichlorophenol	35	45-110	55-124	35
2,4-Dichlorophenol	35	45-110	49-123	35
2,4-Dimethylphenol	35	30-105	41-136	35
2,4-Dinitrophenol	35	15-130	10-174	35
2,4-Dinitrotoluene	35	50-115	67-126	35
2,6-Dinitrotoluene	35	50-110	66-126	35
2-Chloronaphthalene	35	45-105	55-121	35
2-Chlorophenol	35	45-105	48-115	35
2-Methyl-4,6-dinitrophenol	35	30-135	10-196	35
2-Methylnaphthalene	35	45-105	37-131	35
2-Methylphenol	35	40-105	52-121	35
2-Nitroaniline	35	45-120	69-120	35
2-Nitrophenol	35	40-110	53-114	35
3 & 4-Methylphenol	35	40-105	62-142	35
3,3'-Dichlorobenzidine	35	10-130	27-128	35
3-Nitroaniline	35	25-110	67-125	35
4-Bromophenyl-phenylether	35	45-115	53-118	35
4-Chloro-3-Methylphenol	35	45-115	63-118	35
4-Chloroaniline	35	10-95	49-123	35
4-Chlorophenyl-phenylether	35	45-110	58-125	35

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES

Parameters	Precision (Relative Percent Difference)	Accuracy % of Spike Recovery		Field Duplicate RPD Acceptance Criteria
4-Nitroaniline	35	35-115	62-128	35
4-Nitrophenol	35	15-140	25-132	35
Acenaphthene	35	45-110	60-127	35
Acenaphthylene	35	45-105	68-124	35
Anthracene	35	55-105	67-127	35
Benzidine	35	5-63	5-47	35
Benzo(a)anthracene	35	50-110	68-120	35
Benzo(a)pyrene	35	50-110	69-121	35
Benzo(b)fluoranthene	35	45-115	59-134	35
Benzo(g,h,i)perylene	35	40-125	28-142	35
Benzo(k)fluoranthene	35	45-125	59-130	35
Benzoic Acid	35	0-110	10-138	35
Benzyl Alcohol	35	20-125	50-109	35
bis(2-Chloroethoxy)methane	35	45-110	53-122	35
bis(2-Chloroethyl)ether	35	40-105	44-120	35
bis(2-Chloroisopropyl)ether	35	20-115	53-120	35
bis(2-Ethylhexyl)phthalate	35	45-125	64-138	35
Butylbenzyl phthalate	35	50-125	65-141	35
Carbazole	35	45-115	68-122	35
Chrysene	35	55-110	59-136	35
Dibenzo(a,h)anthracene	35	40-125	46-134	35
Dibenzofuran	35	50-105	62-124	35
Diethyl phthalate	35	50-115	56-130	35
Dimethyl phthalate	35	50-110	60-126	35
di-n-Butylphthalate	35	55-110	66-129	35
di-n-Octylphthalate	35	40-130	49-170	35
Fluoranthene	35	55-115	65-124	35
Fluorene	35	50-110	64-121	35
Hexachlorobenzene	35	45-120	59-129	35
Hexachlorobutadiene	35	40-115	38-138	35
Hexachlorocyclopentadiene	35	35-151	10-141	35
Hexachloroethane	35	35-110	46-106	35
Indeno(1,2,3-cd)pyrene	35	40-120	36-138	35
Isophorone	35	45-110	57-118	35
Naphthalene	35	40-105	49-119	35
Nitrobenzene	35	40-115	41-118	35
n-Nitrosodimethylamine	35	20-115	30-112	35
n-Nitroso-di-n-propylamine	35	40-115	57-113	35

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES				
Parameters	**Precision (Relative Percent Difference)**	**Accuracy % of Spike Recovery**		**Field Duplicate RPD Acceptance Criteria**
n-Nitrosodiphenylamine	35	50-115	49-146	35
Pentachlorophenol	35	25-120	12-144	35
Phenanthrene	35	50-110	56-136	35
Phenol	35	40-100	35-126	35
Pyrene	35	45-125	64-140	35
TCL Pesticides and PCBs		**LCS**	**MS/MSD**	
4,4'-DDD	30	30-135	45-170	35
4,4'-DDE	30	70-125	51-133	35
4,4'-DDT	30	45-140	42-172	35
Aldrin	30	45-140	56-139	35
Alpha-BHC	30	60-125	75-124	35
Beta-BHC	30	60-125	55-134	35
Delta-BHC	30	55-130	63-141	35
Dieldrin	30	65-125	69-124	35
Endosulfan I	30	15-135	64-120	35
Endosulfan II	30	35-140	69-118	35
Endosulfan Sulfate	30	60-135	62-141	35
Endrin	30	60-135	61-147	35
Endrin Aldehyde	30	35-145	23-136	35
Endrin Ketone	30	65-135	58-153	35
Gamma-BHC (Lindane)	30	60-125	70-116	35
Heptachlor	30	50-140	73-123	35
Heptachlor Epoxide	30	65-130	58-128	35
Methoxychlor	30	55-145	45-169	35
Toxaphene	NA	60-150	NA	35
Chlordane	NA	60-150	NA	35
Aroclor 1016	30	40-140	69-126	35
Aroclor 1221	NA	NA	NA	35
Aroclor 1232	NA	NA	NA	35
Aroclor 1242	NA	NA	NA	35
Aroclor 1248	NA	NA	NA	35
Arclor 1254	NA	NA	NA	35
Aroclor 1260	30	60-130	62-152	35
TCLP ANALYSES				
TCLP Metals		**LCS**	**MS/MSD**	
Arsenic	25	80-120	75-125	40
Barium	25	80-120	75-125	40

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES

Parameters	Precision (Relative Percent Difference)	Accuracy % of Spike Recovery		Field Duplicate RPD Acceptance Criteria
Cadmium	25	80-120	75-125	40
Chromium	25	80-120	75-125	40
Lead	25	80-120	75-125	40
Selenium	25	80-120	75-125	40
Silver	25	80-120	75-125	40
Mercury	25	80-120	75-125	40
TCLP VOCs	**LCS/LCSD**	**LCS**	**MS**	
Vinyl Chloride	20	57-127	54-125	40
1,1-Dichloroethene	20	70-123	70-123	40
Chloroform	20	71-130	71-124	40
2-Butanone	20	66-156	59-177	40
1,2-Dichloroethane	20	75-125	74-123	40
Carbon Tetrachloride	20	70-125	67-114	40
Trichloroethene	20	78-118	73-119	40
Benzene	20	78-119	81-114	40
Tetrachloroethene	20	71-119	72-116	40
Chlorobenzene	20	81-115	81-113	40
TCLP SVOCs	**LCS/LCSD**	**LCS**	**MS**	
Pyridine	30	7-52	5-66	35
1,4-Dichlorobenzene	30	46-95	51-110	35
Nitrobenzene	30	61-93	44-129	35
Hexachloroethane	30	44-101	42-107	35
Hexachlorobutadiene	30	51-114	54-116	35
2,4,6-Trichlorophenol	30	62-101	50-122	35
2,4,5-Trichlorophenol	30	60-105	47-128	35
2,4-Dinitrotoluene	30	72-113	48-133	35
Hexachlorobenzene	30	67-127	50-127	35
Pentachlorophenol	30	54-132	30-146	35
Total Cresols	30	37-76	26-114	35
TCLP Pesticides	**LCS/LCSD**	**LCS**	**MS**	
Endrin	25	80-151	58-148	35
Gamma-BHC	25	78-124	55-125	35
Heptachlor	25	71-139	55-134	35
Heptachlor Epoxide	25	75-124	35-132	35
Methoxychlor	25	64-142	43-165	35
TCLP Herbicides	**LCS/LCSD**	**LCS**	**MS**	
2,4,5-TP	30	70-144	78-146	35

TABLE 3-2: PRECISION AND ACCURACY OBJECTIVES

Parameters	Precision (Relative Percent Difference)	Accuracy % of Spike Recovery		Field Duplicate RPD Acceptance Criteria
2,4-D	30	57-151	41-171	35
RCRA Characteristics		**LCS**	**MS**	
Ignitability	35	NA	NA	NA
Corrosivity	35	NA	NA	NA
Reactive Sulfide	35	66-109	66-109	NA
Reactive Cyanide	35	7-12	2-20	NA
WATER MATRICES				
Total PCBs		**LCS**	**MS/MSD**	
Aroclor 1016	30	25-145	25-145	35
Aroclor 1221	NA	NA	NA	35
Aroclor 1232	NA	NA	NA	35
Aroclor 1242	NA	NA	NA	35
Aroclor 1248	NA	NA	NA	35
Arclor 1254	NA	NA	NA	35
Aroclor 1260	30	30-145	30-145	35
WIPE SAMPLES				
Total PCBs		**LCS**	**MS/MSD**	
Aroclor 1016	NA	60-144	NA	NA
Aroclor 1221	NA	NA	NA	NA
Aroclor 1232	NA	NA	NA	NA
Aroclor 1242	NA	NA	NA	NA
Aroclor 1248	NA	NA	NA	NA
Arclor 1254	NA	NA	NA	NA
Aroclor 1260	NA	60-142	NA	NA

- **Representativeness.** Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population of samples, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling strategies and techniques. The sampling program was designed so that the samples collected are as representative as possible of the medium being sampled and that a sufficient number of samples are collected. It is the intent of the sampling effort to collected samples which meet the offsite disposal facility requirements. Typically, the offsite disposal facilities require that one sample is collected for every 500yd^3 of material being disposed of. The determination of representativeness of the data will be performed by:

- Comparing actual sampling procedures to those described in Section 4.0 of the FSP.
- Identifying and eliminating non-representative data.
- Comparing analytical results of field duplicate samples.
- Evaluating holding times and condition of samples on arrival at the laboratory.
- Examining blanks for cross contamination.
- In the laboratory, making certain that all sub-samples taken from a given sample are representative of the entire sample.

The representativeness objective of this SAP is to eliminate all non-representative data. If, during the data evaluation, results indicate that a sample is not representative, Sevenson will notify the USACE and provide recommendations for an alternate location or sampling method.

- **Comparability.** Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through employing narrowly defined sampling methodologies, site audits/surveillances, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Thus, this objective will be met by following techniques and methods set forth in the SAP.

- **Completeness.** Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under normal conditions. The total number of samples required will be determined in the field based on the requirements of the offsite disposal facility. Completeness is determined as a percentage using the formula given in Section 8.4 of this QAPP. To be considered complete and valid, the reported data set must meet all acceptance criteria including precision and accuracy in accordance with the specified analytical method being used.

  The following completeness criteria shall be met:

  1. COMPLETENESS FOR SAMPLE COLLECTION. Completeness for sample collection is defined as the percentage of specified samples listed in the FSP that were actually collected. The completeness for sample collection will be 95%.

2. COMPLETENESS FOR ACCEPTABLE DATA. Completeness for acceptable data is defined as the percentage of acceptable data out of the total amount of data generated. This completeness will be 95% for each analytical method. Acceptable data includes data that has passed all QC criteria and data which may have not passed all criteria but which had appropriate corrective actions taken.

3. COMPLETENESS FOR QUALITY DATA. Completeness for quality data is defined as the percentage of quality data out of the total amount of data generated. The completeness shall be 95%. Quality data is that data that has passes all applicable quality control criteria specified in the QAPP.

- **Sensitivity.** Sensitivity is a measure of a method's detection limit and ability to distinguish between two values. The method detection limit (MDL) is the smallest reportable concentration in a sample within a specified level of confidence, while method quantitation limits (MQL) represent the sum of all of the uncertainties in the analytical procedure plus a risk factor. Hence, the method quantitation limit is based on the method detection limit. Additionally, the lowest calibration standard is typically set at the MQL. The laboratory MQLs for the samples generated through the FSP and the analytical methods that will be used to achieve the appropriate sensitivities are given in Table 3-3 on an analyte-by-analyte basis.

TABLE 3-3: METHOD QUANTIATION LIMITS

Constituent	MQL
TAL Metals (mg/Kg)	
Aluminum	2.50
Antimony	1.40
Arsenic	1.70
Barium	1.00
Beryllium	0.50
Cadmium	1.00
Calcium	2.40
Chromium	1.00
Cobalt	1.00
Copper	1.00
Iron	8.30
Lead	4.10
Magnesium	12.0

TABLE 3-3: METHOD QUANTIATION LIMITS	
Constituent	**MQL**
Manganese	1.00
Nickel	1.00
Potassium	14.0
Selenium	1.40
Silver	0.50
Sodium	12.0
Thallium	1.30
Vanadium	1.00
Zinc	4.00
Mercury	0.014
TCL VOCs (µg/Kg)	
1,1,1,2-Tetrachloroethane	2.0
1,1,1-Trichloroethane	2.0
1,1,2,2-Tetrachloroethane	2.0
1,1,2-Trichloroethane	2.0
1,1-Dichloroethane	2.0
1,1-Dichloroethene	2.0
1,2-Dichloroethane	2.0
1,2-Dichloropropane	2.0
2-Butanone	10.0
2-Hexanone	10.0
4-Methyl-2-pentanone	10.0
Acetone	10.0
Acrylonitrile	10.0
Benzene	2.0
Bromodichloromethane	2.0
Bromoform	2.0
Bromomethane	10.0
Carbon Disulfide	2.0
Carbon Tetrachloride	2.0
Chlorobenzene	2.0
Chloroethane	10.0
Chloroform	2.0
Chloromethane	10.0
cis-1,2-Dichloroethene	2.0
cis-1,2-Dichloropropene	2.0
Dibromochloromethane	2.0
Ethylbenzene	2.0
m,p-Xylene	4.0
Methylene Chloride	2.0

TABLE 3-3: METHOD QUANTIATION LIMITS	
Constituent	**MQL**
o-Xylene	2.0
Styrene	2.0
Tetrachloroethene	2.0
Toluene	2.0
trans-1,2-Dichloroethene	2.0
trans-1,3-Dichloropropene	2.0
Trichloroethene	2.0
Vinyl Acetate	10.0
Vinyl Chloride	10.0
TCL SVOCs (µg/Kg)	
1,2,4-Trichlorobenzene	67
1,2-Dichlorobenzene	67
1,3-Dichlorobenzene	67
1,4-Dichlorobenzene	67
2,4,5-Trichlorophenol	67
2,4,6-Trichlorophenol	130
2,4-Dichlorophenol	130
2,4-Dimethylphenol	130
2,4-Dinitrophenol	130
2,4-Dinitrotoluene	67
2,6-Dinitrotoluene	67
2-Chloronaphthalene	67
2-Chlorophenol	130
2-Methyl-4,6-dinitrophenol	130
2-Methylnaphthalene	67
2-Methylphenol	67
2-Nitroaniline	67
2-Nitrophenol	130
3 & 4-Methylphenol	130
3,3'-Dichlorobenzidine	67
3-Nitroaniline	67
4-Bromophenyl-phenylether	67
4-Chloro-3-Methylphenol	133
4-Chloroaniline	67
4-Chlorophenyl-phenylether	67
4-Nitroaniline	67
4-Nitrophenol	130
Acenaphthene	67
Acenaphthylene	67
Anthracene	67

TABLE 3-3: METHOD QUANTIATION LIMITS	
Constituent	**MQL**
Benzidine	330
Benzo(a)anthracene	67
Benzo(a)pyrene	67
Benzo(b)fluoranthene	67
Benzo(g,h,i)perylene	67
Benzo(k)fluoranthene	67
Benzoic Acid	330
Benzyl Alcohol	67
bis(2-Chloroethoxy)methane	67
bis(2-Chloroethyl)ether	67
bis(2-Chloroisopropyl)ether	67
bis(2-ethylhexyl)phthalate	67
Butylbenzyl phthalate	67
Carbazole	67
Chrysene	67
Dibenzo(a,h)anthracene	67
Dibenzofuran	67
Diethyl phthalate	67
Dimethyl phthalate	67
di-n-Butyl phthalate	67
di-n-Octylphthalate	67
Fluoranthene	67
Fluorene	67
Hexachlorobenzene	67
Hexachlorobutadiene	67
Hexachlorocyclopentadiene	130
Hexachloroethane	67
Indeno(1,2,3-cd)pyrene	67
Isophorone	67
Naphthalene	67
Nitrobenzene	67
n-Nitrosodimethylamine	67
n-Nitroso-di-n-propylamine	67
n-Nitrosodiphenylamine	67
Pentachlorophenol	130
Phenanthrene	67
Phenol	130
Pyrene	67

TABLE 3-3: METHOD QUANTIATION LIMITS	
Constituent	**MQL**
TCL Pesticides and PCBs (µg/Kg)	
4,4'-DDD	0.4
4,4'-DDE	0.4
4,4'-DDT	0.4
Aldrin	0.4
Alpha-BHC	0.4
Beta-BHC	0.4
Chlordane	6.7
Delta-BHC	0.4
Dieldrin	0.4
Endosulfan I	0.4
Endosulfan II	0.4
Endosulfan Sulfate	0.4
Endrin	0.4
Endrin Aldehyde	0.4
Endrin Ketone	0.4
Gamma-BHC (Lindane)	0.4
Heptachlor	0.4
Heptachlor Epoxide	0.4
Methoxychlor	0.4
Toxaphene	8.3
Aroclor 1016	3.3
Aroclor 1221	3.3
Aroclor 1232	3.3
Aroclor 1242	3.3
Aroclor 1248	3.3
Arclor 1254	3.3
Aroclor 1260	3.3
Total PCBs (µg/L)	
Aroclor 1016	0.05
Aroclor 1221	0.1
Aroclor 1232	0.05
Aroclor 1242	0.05
Aroclor 1248	0.05
Arclor 1254	0.05
Aroclor 1260	0.05
TCLP Metals (mg/L)	
Arsenic	0.045
Barium	0.025

TABLE 3-3: METHOD QUANTIATION LIMITS	
Constituent	**MQL**
Cadmium	0.025
Chromium	0.025
Lead	0.075
Mercury	0.001
Selenium	0.095
Silver	0.025
TCLP VOCs (µg/L)	
Vinyl Chloride	10.0
1,1-Dichloroethene	10.0
2-Butanone	100.0
Chloroform	10.0
Carbon Tetrachloride	10.0
Benzene	10.0
1,2-Dichloroethane	10.0
Trichloroethene	10.0
Tetrachloroethene	10.0
Chlorobenzene	10.0
1,4-Dichlorobenzene	10.0
TCLP SVOCs (µg/L)	
Pyridine	2.0
1,4-Dichlorobenzene	2.0
2-Methylphenol	2.0
3&4-Methylphenol	4.0
Hexachloroethane	2.0
Nitrobenzene	2.0
Hexachlorobutadiene	2.0
2,4,6-Trichlorophenol	2.0
2,4,5-Trichlorophenol	2.0
2,4-Dinitrotoluene	2.0
Hexachlorobenzene	2.0
Pentachlorophenol	4.0
TCLP Pesticides (µg/L)	
gamma-BHC (Lindane)	0.010
Heptachlor	0.010
Heptachlor Epoxide	0.010
Endrin	0.010
Methoxychlor	0.010
Toxaphene	0.250
Chlordane	0.200

TABLE 3-3: METHOD QUANTIATION LIMITS	
Constituent	**MQL**
TCLP Herbicides (µg/L)	
2,4-D	0.40
2,4,5-TP	0.40
RCRA Characteristics	
Ignitability (°F)	NA
Corrosivity	NA
Reactive Sulfide (mg/Kg)	40
Reactive Cyanide (mg/Kg)	40
PCB Wipe Samples (µg/100cm^2)	
Aroclor 1016	0.10
Aroclor 1221	0.10
Aroclor 1232	0.10
Aroclor 1242	0.10
Aroclor 1248	0.10
Arclor 1254	0.10
Aroclor 1260	0.10

- **Documentation.** Documentation is a method of tracking site samples and chemical data. All samples and site conditions affecting chemical data shall be documented in sample collection logs, chain-of-custody forms, and sample receipt checklists. Documentation shall also include, but not be limited to, the completion of all forms or checklists (i.e. records of conversations, cooler receipt forms, corrective action forms, etc.). Any changes to the sampling, shipping or receiving information, analytical raw data, or chemical results shall be lined out, initialed, and dated by the person responsible for making the change. Also, all deviations from the accepted sampling procedures and analytical methods will be documented and communicated to the Contracting Office or a Designated Representative; if any corrective actions are necessary, they will be approved and documented as well. Finally, all reports and data packages shall be reviewed and approved by the Project Chemist before submittal to the USACE.

- **Data Reporting.** Data reporting will follow the requirements as prescribed in Chapter 2 of EM 200-1-6 (USACE 1997). Chemical data packages will contain, but not be limited to, the following: all applicable sample tracking information; a laboratory case narrative; all analytical results with detection limits, dilution factors, percent moisture for solid samples, and any laboratory qualifications or flags; results of any sample dilutions performed to bring the sample data within the appropriate calibration

range; all internal and field-initiated quality control parameters including all associated laboratory blanks, surrogate and matrix spike/matrix spike duplicate percent recoveries with control limits, laboratory duplicates or matrix spike duplicate pair RPDs with control limits, laboratory control samples with control limits, and field blanks. In addition, all preparation and analytical methods shall be provided with the analytical results in the data package.

Once completed, the laboratory will submit each finished data package to Sevenson's project chemist within 21 days of the validated time of sample receipt by the laboratory, unless otherwise specified. In addition to the hard copy of the data package, the laboratory will provide an electronic copy of the data in Staged Electronic Data Deliverable (SEDD) format. Laboratory data will be reviewed in accordance with *Kansas City District Data Quality Evaluation Guidance* (USACE, 2003). Following approval of the reviewed data package by Sevenson's project chemist and QC manager, a copy will be sent to the USACE Contracting Officer of a Designated Representative. Copies of data packages will also be included in the Quality Control Summary Report (QCSR). The content of the QCSR is discussed in Section 8.3 of the FSP.

Sevenson and/or the contract laboratory will maintain all supporting data, documentation, and raw analytical data on file for a period of at least three years after the completion of the project.

- **Data Validation and Review.** Commensurate with the data reporting requirements, the data reporting packages will be reviewed and confirmed by the offsite laboratory as per the requirements of the particular analytical methodology prior to releasing the report to Sevenson. Sevenson will perform data review on all generated analytical data in accordance with the USACE guidelines referenced above and summarized in Section 10.5. Data review will be performed by Sevenson under the supervision of the Project Chemist.

3.4 Quality Control Checks

Implementation of quality control procedures during sample collection, analysis, and reporting ensures that the data obtained are consistent with its intended use. Both field QC and laboratory QC checks are performed throughout the work effort to generate data confidence. Field QC samples will be collected at the Site and submitted to the contract laboratory for analysis in order to evaluate the overall field sampling and laboratory

analysis processes, as well as to determine the sample matrix effects on the data being generated. Laboratory QC samples will be prepared and analyzed by the contract laboratory in order to determine and assess analytical quality control and performance. Sample preservation and analytical holding time requirements play a key role in producing quality data. As these are method-specific, a basic guideline has been prepared for this project on an analysis-by-analysis basis, as represented in Tables 3-4. If further detail is required, the respective method(s) should be consulted.

3.4.1 Field Quality Control

The applicability and appropriateness of the field sampling protocol can be verified by the inclusion of a program of scheduled field control samples, such as field replicates, field blanks, and background samples. All field control samples should be handled exactly as the Site samples. The identity of the field control samples will be held blind to the laboratory until the data are reported.

- **Field Replicates.** A field replicate sample is a second sample collected at the same location as the original sample used as an indicator of overall measurement (sampling and analytical) precision. Replicate samples are collected using identical sampling techniques, and treated in an identical manner during storage, transportation, and analysis. QC samples will be collected as one sample, homogenized and split into two samples, separately containerized and shipped as two independent samples. Field QC samples will be collected at a rate of 5 percent of the total number of field samples that are collected for laboratory analysis per matrix. Due to the nature of the sampling activities (i.e., waste disposal characterization), replicate samples are not anticipated to be collected unless otherwise directed by the USACE, USEPA, or Sevenson QA Manager. If required, field QC samples will be shipped to the contractor's primary analytical laboratory blindly, with notations made in the daily sample log as to which environmental sample the QC sample is associated. Results of blind replicate QC samples will be submitted in the data packages and reports along with the results of the regular samples. The QCSR will include comparison and evaluation of the blind replicate QC sample results. Comparison of results between the QC replicates will be based on calculation of relative percent difference and comparison of the resultant RPD to the method-specific acceptance criteria included in Table 3-2.

Table 3-4: Sampling and Analysis Matrix

Sample	*Location*	*Rationale*	*Parameter(s)*	*Sample Type*	*Type of Bottles*[1,2]	*Number of Bottles*[1,2]	*Methodology*	*Holding Time*[3]	*Preservative*
Solid Waste Characterization	Building walls and floors per construction drawings	Meet federal, state, and local regulations in accordance with the requirements of the disposal facility	Ignitability	Composite	32oz. CWM	1	SW-846 1010	7 days	Cool 4°C
			Corrosivity				SW-846 9045C	Immediately	
			Reactive Cyanide				SW-846 Section 7.4.3.2/ Method 9014	14 days	
			Reactive Sulfide				SW-846 Section 7.4.4.2/ Method 9034	7 days	
			TCLP Metals				SW-846 1311/3015/6010B/ 7470A	180 days to TCLP extraction (Hg 28 days) 180 days to analysis (Hg 28 days)	
			TCLP SVOCs				SW-846 1311/3510C/8270C	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
			TCLP Pesticides				SW-846 1311/3510C/8081A	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
			TCLP Herbicides				SW-846 1311/3510C/8151A	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
			Total PCBs	Composite	4 oz. CWM	1	SW-846 3550C/8082	14 days to extraction 40 days to analysis	Cool 4°C
			TCLP VOCs	Grab	4 oz. CWM	2	SW-846 1311/5030B/8260B	14 days to TCLP extraction 14 days to analysis	Cool 4°C
Concrete	Concrete pads	Meet federal, state, and local regulations in accordance with the requirements of the disposal facility	Total PCBs	Composite	2 oz. CWM	1	SW-846 3550C/8082	14 days to extraction 40 days to analysis	Cool 4°C
			TCLP Metals	Composite	2oz. CWM	2	SW-846 3050/6010B/7471A	180 days to TCLP extraction (Hg 28 days) 180 days to analysis (Hg 28 days)	Cool 4°C
Wastewater[4]	Storage tank	Meet federal, state, and local regulations in accordance with the requirements of the disposal facility	Ignitability	Composite	1L AG	3	SW-846 1010	7 days	Cool 4°C
			Corrosivity				SW-846 9040C	Immediately	
			Reactive Cyanide				SW-846 Section 7.4.3.2/ Method 9014	14 days	
			Reactive Sulfide				SW-846 Section 7.4.4.2/ Method 9034	7 days	
			TCLP Metals				SW-846 1311/3015/6010B/ 7470A	180 days to TCLP extraction (Hg 28 days) 180 days to analysis (Hg 28 days)	
			TCLP SVOCs				SW-846 1311/3510C/8270C	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	

Sample	Location	Rationale	Parameter(s)	Sample Type	Type of Bottles[1,2]	Number of Bottles[1,2]	Methodology	Holding Time[3]	Preservative
			TCLP Pesticides				SW-846 1311/3510C/8081A	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
			TCLP Herbicides				SW-846 1311/3510C/8151A	14 days to TCLP extraction 7 days to preparative extraction 40 days to analysis	
			TCLP VOCs	Grab	40 mL G vial w/Teflon septa	4	SW-846 1311/5030C/8260B	14 days to TCLP extraction 14 days to analysis	Cool 4°C
			Total PCBs	Grab	1L AG	2	SW-846 8082	7 days to extraction 40 days to analysis	Cool 4°C
Backfill/ Topsoil	Off-Site Borrow Source(s)	Establish that backfill and topsoil material brought on-Site for restoration activities are not hazardous to human health or the environment	VOCs	Grab	EnCore™ sampler	2	SW-846 5035/8260B	48 hours to preservation by laboratory 14 days to analysis	Cool 4°C
			TCL SVOCs	Composite	2oz. CWM	2	SW-846 3550C/8270C	14 days to extraction 40 days to analysis	Cool 4°C
			TCL Pesticides	Composite	2oz. CWM	2	SW-846 3550C/8081A	14 days to extraction 40 days to analysis	Cool 4°C
			Total PCBs	Composite	2oz. CWM	2	SW-846 3550C/8082	14 days to extraction 40 days to analysis	Cool 4°C
			Cyanide	Composite	2oz. CWM	2	SW-846 Section 7.4.3.2/ Method 9014	14 days	Cool 4°C
			TAL Metals	Composite	2oz. CWM	2	SW-846 3050/6010B/7471A	180 days to digestion 180 days to analysis (Hg 28 days)	Cool 4°C
Wipe	Non-porous surfaces	Establish disposal requirements	Total PCBs	Wipe	3"x3" gauze soaked with 1:4 acetone/hexane	1	SW-846 8082	14 days to extraction 40 days to analysis	Cool 4°C

Notes:
[1] Bottle types – AG: Amber Glass; HDPE: High Density Polyethylene Plastic; CWM: Clear wide mouth glass jar with Teflon lid
[2] All bottles should be filled completely with zero headspace
[3] From Verified Time of Sample Collection
[4] For TCLP analysis on aqueous samples, the laboratory will filter the sample and the aqueous filtrate becomes the TCLP extract. If the aqueous sample contains visible solids, then a percent dry solids determination is performed. If the percent dry solids is >0.5% (about 50g of solids in 1L of aqueous sample), a TCLP extraction will be performed if there is at least 130g of solids present. The aqueous filtrate and TCLP extract are combined for analysis.

- **Temperature Blanks.** A temperature blank is a container of water packaged in the shipping cooler, along with field samples, which will represent the temperature of the incoming cooler upon receipt at the laboratory. Use of these samples within a shipping container enables the receiving laboratory to assess the temperature of shipment without disturbing any project field samples.

- **Trip Blanks.** Trip blanks will be included in all shipments containing aqueous VOC samples. A trip blank is an aliquot of analyte-free water that is sealed in a 40mL glass vial with a Teflon-lined septum cap prior to initiation of field work. These samples are kept with the field sample containers from the time they leave the laboratory until they are returned for analysis. The trip blank is used to determine whether samples are being contaminated during transit or sample collection. These sealed bottles will be prepared by the laboratory and included with each shipment of sample bottled for aqueous media to and from the laboratory and the site.

3.4.2 Laboratory Quality Control

Laboratory quality control will occur as described below.

- **Method Blanks.** In order to assess the laboratory's ability to perform each analytical method, a method blank must be analyzed with each group of site samples. A method blank is a sample of a non-contaminated substance of the matrix of interest (usually distilled/deionized water or silica sand) that is then subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the laboratory that might be introduced during sample preparation and analysis that would adversely affect analytical results. Ideally, all blanks should demonstrate freedom from contamination and interferences. If, however, laboratory contamination is suspected, the magnitude of the contamination can be evaluated, but the samples results will not be adjusted to compensate for the blank concentrations. If the method blanks contain target analytes at concentrations greater than the reporting limits, the laboratory will exercise corrective actions as specified in Section 6.0 of the laboratory QA/QC Plan (Appendix B). This may entail re-preparing and reanalyzing the affected Site samples after the source of contamination has been identified and eliminated.

A method blank must be analyzed with each sample batch, where a sample batch is defined as a group of up to twenty (20) samples that are all processed simultaneously as a unit. After analysis, the method blanks may be compared to field and trip blanks in order to give an indication of where in the sampling/analysis process contamination may have been introduced.

- **Laboratory Control Samples.** Laboratory control samples (LCS) are intended to evaluate the accuracy of the analytical method, as performed by the contract laboratory, in the absence of matrix interference. The LCS contains known concentrations of analytes representative of the contaminants to be determined and is carried through the entire preparation and analysis process. The actual analyte concentration and percent recovery will be reported with the laboratory QC data. One LCS will be analyzed with each analytical sample batch.

- **Laboratory Duplicates.** Laboratory duplicates are separate aliquots of a single sample that are prepared and analyzed concurrently at the laboratory. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. In contrast to field duplicate and QA samples, laboratory duplicate samples are originated in the laboratory and measure analytical precision only, while the field duplicates measure the precision of the sampling and analysis process as a whole. As such, they give some indication of the amount of matrix interference inherent in a sample.

- **Laboratory Matrix Spike/Matrix Spike Duplicates.** The primary purpose of matrix spike/matrix spike duplicate samples is to assess the effect of sample matrix on the accuracy and precision of the analyses. A MS is an aliquot of a sample spiked with known quantities of analytes and subjected to the entire analytical procedure. It is used to indicate the appropriateness of each method for the matrix by measuring recovery or accuracy (i.e., the nearness of a result to the true or accepted value). A MSD is a second aliquot of the same sample with known quantities of compounds added which is carried through the identical analytical process as the associated field samples. The purpose of the MSD, when compared to the MS, is to determine method precision (i.e., measure of the reproducibility of a set of replicate results).

  The contract laboratory will be required to run MS/MSD samples when analyzing all sample parameters. MS and MSD analyses are performed per 20 samples of similar matrix. To be executed

properly, MS/MSD samples are prepared by homogenizing a sample and taking three (3) representative sample aliquots from the container. One of these will be analyzed as a normal sample; the remaining aliquots serve as the MS and MSD samples and are prepared as described above. After analysis, the percent recoveries of the matrix spike and the matrix spike duplicate samples will be calculated with respect to the original concentration in the sample and the relative percent difference between the two will be determined.

- **Surrogate Spiking Activity.** A surrogate spike is prepared by adding a pure compound to each and every organic sample before extraction. These surrogate standards will be different for each type of organic analysis, as each surrogate compound is closely related to the group of chemicals being analyzed. The primary function of the surrogate spiking activity is to determine the efficiency of recovery of analytes in the sample preparation and analysis and thus the degree to which the sample matrix plays a role in the organic analysis. This matrix interference will be measured as a percent recovery, which is then used to gauge the total accuracy of the analytical method for that sample. Table 3-5 shows a breakdown of the surrogate compounds related to each type of analysis and the associated acceptable percent recovery ranges of each.

TABLE 3-5: SURROGATE PERCENT RECOVERY CRITERIA FOR ORGANIC ANALYSES

Compounds	TCLP Percent Recovery Limits	Solid Percent Recovery Limits
VOCs		
4-Bromofluorobenzene	85-123	85-120
1,2-Dichloroethane-d4	66-123	NA
Toluene-d_8	81-118	85-115
SVOCs		
Phenol-d_5	10-35	40-100
2-Fluorophenol	14-53	35-105
2,4,6-Tribromophenol	45-124	35-125
Nitrobenzene-d5	38-96	35-100
2-Fluorobiphenyl	41-95	45-105
Terphenyl-d_{14}	42-127	30-125
Pesticides and PCBs		
Tetrachloro-m-xylene	63-132	70-125
Decachlorobiphenyl	71-137	55-130

TABLE 3-5: SURROGATE PERCENT RECOVERY CRITERIA FOR ORGANIC ANALYSES		
Compounds	**TCLP Percent Recovery Limits**	**Solid Percent Recovery Limits**
Herbicides		
DCAA	25-153	NA

3.5 Assessment of Data Quality and Acceptability

QC samples will be continually evaluated and assessed to determine the usefulness of the data from sampling and analysis. The Project Chemist will review and/or verify data quality in accordance with the guidelines and evaluation criteria set forth in the whole of this section. Additionally, the laboratory will perform a review of its internal quality control checks per Section 5.0 of the QA/QC Plan.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of the instruments and measuring equipment that are used for conducting laboratory analyses. These instruments and equipment shall be calibrated prior to each use or on a scheduled, periodic basis according to manufacturer instructions.

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. Procedures and records of calibration will follow USACE reviewed laboratory-specific QA Plans.

In all cases where analyses are conducted according to SW-846 protocols, the calibration procedures and frequencies specified in the applicable methods will be followed. For analyses governed by SOPs, refer to the appropriate SOP for the required calibration procedures and frequencies. All analytical calibrations and method QC will be consistent with the DOD *QSM* (DOD, 2006). Calibration requirements are summarized in Table 6-1 (DOD, 2006).

TABLE 6-1: CALIBRATION REQUIREMENTS

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Comments
Organic Analysis by Gas Chromatography/Mass Spectrometry (Methods 8260, 8270)				
Minimum 5-point initial calibration for all analytes	Initial calibration prior to sample analysis	Average response factor (RF): VOCs: ≥0.30 SVOCs: ≥0.050 Relative standard deviation (RSD): VOCs and SVOCs: ≤30% and one option below; (1) RSD for each analyte ≤15% (2) Linear least squares regression r≥0.995 (3) Non-linear regression – coefficient of determination r^2≥0.99	Correct problem then repeat initial calibration	Problem must be corrected. No samples may be run until initial calibration has passed.

TABLE 6-1: CALIBRATION REQUIREMENTS				
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Comments**
Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ±25% of expected value	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.
Calibration Verification	Daily, before sample analysis, and every 12 hours of analysis time	Average RF: VOCs: ≥0.30 SVOCs: ≥0.050 % Difference/Drift: VOCs and SVOCs: ≤20% difference	Correct problem then rerun calibration verification. If that fails, repeat initial calibration.	
Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography (Methods 8015, 8081, 8082)				
Minimum 5-point initial calibration for all analytes	Initial calibration prior to sample analysis	One of the options below (Method 8082 may only use Option 1 or 2); (1) RSD for each analyte ≤20% (2) Linear least squares regression r≥0.995 (3) Non-linear regression – coefficient of determination r^2≥0.99	Correct problem then repeat initial calibration	Problem must be corrected. No samples may be run until initial calibration has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor. In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.
Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ±20% of expected value	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.

TABLE 6-1: CALIBRATION REQUIREMENTS				
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Comments**
Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)	ICV: Daily, before sample analysis. CCV: After every 10 field samples and at the end of the analysis sequence.	All analytes within ±20% of expected value	ICV: Correct problem then rerun ICV. If that fails, repeat initial calibration. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	If %D for an individual analyte is >20%, no samples may be analyzed until the problem has been corrected.
Inorganic Analysis by Inductively Coupled Plasma (ICP) Atomic Emission Spectrometry and Atomic Absorption Spectrophotometry (AA) (Methods 6010 and 7000 Series)				
Initial calibration for all analytes	Daily initial calibration prior to sample analysis	ICP: No acceptance criteria unless more than one standard is used, in which case $r \geq 0.995$ AA: $r \geq 0.995$	Correct problem and repeat initial calibration	Problem must be corrected. No samples may be run until initial calibration has passed.
Second source calibration verification	Once after each initial calibration, prior to sample analysis	Value of second source for all analytes within ±10% of expected value	Correct problem and verify second source standard. Rerun calibration verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.
Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	ICP: within ±10% of expected value AA: within ±20% of expected value	Correct problem, rerun calibration verification. If that fails, then repeat initial calibration. Reanalyze all samples since the last successful calibration verification.	Problem must be corrected. Results may not be reported without a valid continuing calibration verification.
Low-level calibration check standard (ICP only)	Daily, after one-point initial calibration	Within ±20% of expected value	Correct problem, then reanalyze.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.

Records of calibration will be kept as follows:

- Each instrument will have a record of calibration with an assigned record number.
- A written stepwise calibration procedure will be available for each piece of test and measurement equipment.
- Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag to alert the analyst that the device should not be used.

8.0 CALCULATION OF DATA QUALITY INDICATORS

8.1 Method Detection Limits

To determine the MDL, seven replicates of the appropriate volume of extraction solvent or Type II water are spiked with a known amount of the analyte(s). The amount of the analyte(s) added is the same for all seven replicates and should be at least two-to-three times greater than the instrument detection limit (IDL). The replicates are subjected to the same extraction and analytical procedures as a sample would be and the concentrations of the analyte(s) of interest would be measured. The MDL is defined as the standard deviation of the seven readings multiplied by the student t-test at a 99%, single-sided confidence interval (i.e., t99) using n-1 degrees of freedom (df). The calculation of the MDL should be done in units of weight of the analyte.

The equation that applies to the calculation of the MDL is:

$$MDL = SD\ (t99[1\text{-sided}];df=6);\ \text{or}\ MDL = SD \times 3.143$$

Where: MDL =method detection limit in units of weight for those methods dependent upon absolute quantity, and in concentration units for those dependent on concentration

SD = the standard deviation of the seven readings from the mean, in units of weight or concentration

The method detection limit will be determined for all analytes associated with each method on at least an annual basis. The MDL will also be determined whenever the sample preparation method or extraction method is modified.

8.2 Accuracy

Analytical accuracy may be assessed through the use of known and unknown QC samples and spiked samples, such as matrix spikes or standard reference materials. Accuracy is most commonly presented as percent recovery or percent bias. Percent bias is the reciprocal of percent recovery. Accuracy determined by percent recovery is calculated as follows:

$$\%R = \frac{|SSR - SR|}{SA} \times 100$$

Where: SSR = measured value of the spiked sample
SR = measured value of the unspiked sample
SA = known amount of the spike in the sample

8.3 Precision

Precision is determined from duplicate sample analyses; thus, precision is usually expressed as RPD. Every batch of samples analyzed will include matrix duplicates and/or matrix spike duplicates to evaluate precision in this manner. Precision determined by RPD will be calculated as follows:

$$RPD = \left(\frac{|X_1 - X_2|}{\frac{(X_1 + X_2)}{2}} \right) \times 100$$

Where: X_1 = Concentration of spiked compound recovered from the MS sample or, for duplicate sample analysis, the concentration of the analyte in the original sample analysis

X_2 = Concentration of spiked compound recovered from the MSD sample or, for matrix duplicate samples, the result from the duplicate sample analysis

8.4 Completeness

Completeness is an overall gauge of field sampling and analytical laboratory performance. As discussed in Section 3.3, three types of completeness will be evaluated. "Completeness for Sample Collection" will be calculated for the project as follows:

$$Completeness = \frac{Number\ of\ samples\ collected}{Number\ of\ planned\ samples} \times 100$$

"Completeness for Acceptable Data" will be calculated for the project as follows:

$$Completeness = \frac{Number\ of\ usable\ results}{Number\ of\ reported\ results} \times 100$$

(Usable results are qualified but not rejected data)

"Completeness for Quality Data" will be calculated for the project as follows:

$$Completeness = \frac{Number\ of\ unqualified\ results}{Number\ of\ reported\ results} \times 100$$

9.0 CORRECTIVE ACTIONS

Field corrective action procedures are discussed in Section 9.0 of the FSP. This section discusses corrective actions as they relate to the analytical laboratory.

Corrective actions may be required for two major types of problems: analytical/equipment problems and noncompliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

Noncompliance with specified criteria and analytical/equipment problems will be documented through a formal corrective action program at the time the problem is identified. Laboratory deficiency and tracking notification will be implemented should any deviations or departures from the approved SAP or standard sampling and analysis methodologies which may affect the achievement of project DQOs or the usability of the data be identified throughout the performance of field-dependent (e.g., sample shipping, chain-of-custody) or laboratory activities. Sevenson will work closely with the laboratory to maintain open communication.

Deficiency and corrective action tracking will be implemented through the use of a DNF. A copy of the DNF is included in Appendix A. Any deficiency identified by laboratory personnel will be assigned a tracking number and all pertinent information recorded describing the deficiency and its associated corrective action. The completed DNF will be sent by the laboratory Project Manager via e-mail or facsimile to the Sevenson Project Chemist. Sevenson will notify the USACE Contracting Officer or a Designated Representative when an event requiring corrective action occurs and submit the required deficiency notification/corrective action report so that approval to follow through with the required corrective action may be obtained.

Sevenson personnel will confer with the laboratory as quickly after the notification as practical to discuss the ramifications of the deficiency with regard to project DQOs and potential effects on the reportability and validity of sample data. Deficiencies which may prevent meeting contractual DQOs or which preclude the use of data in final Site reporting may require reanalysis, reevaluation, or resampling. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the Sevenson Project Manager and the USACE Project Manager.

Within the laboratory, a high-level of communication is maintained between the operational and managerial staff in order to promptly address any quality assurance deficiencies that arise. No staff member will initiate corrective action without prior communication of findings through the proper channels. In the event of a non-conformance or analytical method deviation that impacts samples from the Site, the laboratory will notify Sevenson's Project Chemist immediately.

Deficiency notification and corrective actions are necessary if the following conditions exist:

- Any QC data are outside control limits for precision and accuracy.
- Blanks contain target analytes above acceptable levels and must be investigated.
- Undesirable trends are detected in spike or surrogate recoveries or RPD between duplicates.
- There are unusual changes in detection limits.
- The QA department detects deficiencies during internal audits, external audits, or from performance evaluation sample results.
- Inquiries concerning data quality are received from USACE.

9.1 Identification and Documentation of Problem

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation procedures for possible errors, checks the instrument calibration, spike, surrogate, calibration solutions, instrument sensitivity, and so on. The laboratory supervisor, manager, and/or QA department will be advised if the problem persists or cannot be identified. Once resolved, full documentation of the deficiency/corrective action procedure will be submitted to the appropriate Sevenson personnel and filed with the project records. The deficiency and corrective action will also be summarized within the case narrative. If the problem encountered requires that a sample or group of samples be re-extracted and/or reanalyzed, the QA/QC Manager will initiate the corrective action by filling out a Sample Re-Extraction/Reanalysis Form.

Other corrective actions may be required that do not involve sample reanalysis. In these cases, the QA/QC Manager will notify the analyst or technician of a problem through a QC Memorandum. If the problem is significant enough to impact the quality of the data, the QA/QC Manager may stop the analysis of additional samples until the problem is resolved. The analyst or technician must record onto the memo a description of the corrective action(s) taken and the date it was performed. The memo will be returned to the QA/QC

Manager for review. If the corrective action has mitigated the problem, analysis of samples can be resumed. If not, the QA/QC Manager may issue another memo detailing the additional actions that need to be taken in order to resolve the problem.

If, upon repeated attempts, the QA/QC Manager feels that the actions taken have not satisfactorily corrected the problem, he/she will inform the appropriate corporate officer of the problem. The problem will then be resolved through a joint effort between the laboratory management, the QA/QC Manager, and the corporate officer. Any problems affecting the quality of the data from the analysis of samples from the Site will be detailed in the case narrative of the final analytical result report. If it appears that the problem will affect sample holding times or delay the timely reporting of analytical results, the QA/QC Manager will notify the Sevenson Project Manager, CQCSM, and/or Project Chemist.

9.2 Problems and Actions

9.2.1 Sample Receipt

Problems noted during sample receipt will be documented on the cooler receipt form. If irregularities are noted, the Sample Custodian will notify the laboratory Project Manager, who in turn, will initiate the DNF process and contact the Sevenson Project Manager, CQCSM, and/or Project Chemist. A decision concerning the disposition of the sample shipment in question will be made. USACE will also be contacted immediately for problem resolution (e.g., recollect samples, apply data qualifiers, analyze samples "as is", etc.), if necessary. All corrective actions taken will be thoroughly documented on the cooler receipt form. This written record will contain, at a minimum, the time and date of the conversation, the name of the Site contact, the names of any offsite individuals involved in the decision, and the resolution reached with respect to the irregularity. Some examples of irregularities encountered during sample receipt, which may require consultation to determine corrective action, include:

- Custody seal on cooler is broken or appears to have been tampered with.
- Temperature inside cooler is outside the acceptable temperature range.
- Broken sample container(s) or missing container(s).
- Unlabeled, mislabeled, or illegible sample container(s).
- Improperly preserved sample(s).

- VOC vials contain bubbles or air space.
- Chain-of-custody form incomplete, improperly completed, or illegible.

9.2.2 Sample Holding Times

If samples cannot or were not extracted/digested and/or analyzed within the appropriate method required holding times, the Sevenson Project Manager, CQCSM, and USACE Project Manager will be notified immediately for problem resolution. All corrective actions will be thoroughly documented on the DNF, and the case narrative to be included in the final laboratory analytical data report.

9.2.3 Instrument Calibration

Sample analysis will not be allowed until all initial calibrations meet the appropriate requirements. All calibrations must meet method time requirements or recalibration must be performed.

When the continuing calibration is outside the acceptable range, the problem should be identified by the analyst and corrected before any sample analysis is undertaken. If the non-acceptability of the continuing calibration is not determined by the analyst, the QA/QC Manager will notify the appropriate analyst that a new calibration curve must be prepared or the continuing calibration standard should be checked. All continuing calibrations that do not meet method requirements will result in a review of the calibration, rerun of the appropriate calibration standard(s), and, if necessary, reanalysis of all samples affected back to the previous acceptable calibration check.

9.2.4 Calibration Standards

Calibration standards will not be used beyond their permitted shelf life.

9.2.5 Practical Quantitation Limits

Appropriate sample cleanup procedures will be employed to attempt to achieve practical quantitation limits. If difficulties arise in achieving these limits due to a particular sample matrix, the contract laboratory will notify Sevenson's Project Manager, CQCSM, and/or Project Chemist of this problem via a DNF for resolution. Any

dilutions made will be documented in the case narrative along with the revised practical quantitation limits for those analytes directly affected. Analytes detected above the method detection limit, but below the practical quantitation limit will be reported as an estimated value.

9.2.6 Method QC

All method QC, including blanks, matrix duplicates, matrix spikes, matrix spike duplicates, surrogate recoveries, laboratory control samples, and other method-specified QC samples will meet the requirements as specified within the analytical method. Failure of method-required QC will result in the review of all affected data. If no errors can be noted, the affected sample(s) will be reanalyzed and/or re-extracted/redigested, then reanalyzed within method-required holding times to verify the presence or absence of matrix effects. In order to confirm matrix effects, QC results must observe the same direction and magnitude bias. If matrix effect is confirmed, the corresponding data will be flagged. If matrix effect is not confirmed, then the entire batch of samples may have to be reanalyzed and/or re-extracted/redigested, then reanalyzed. Sevenson's Project Manager, CQCSM, and/or Project Chemist and the USACE Project Manager will be notified as soon as possible via a DNF to discuss possible corrective actions should unusually difficult sample matrices be encountered.

9.2.6.1 Laboratory Method Blanks Exceed Method Detection but are Below Quantitation Limits

When laboratory blanks exhibit the presence of target analytes at a level exceeding the method detection limit, but still below the quantitation limit, the QA/QC Officer will notify the responsible analyst, who will check the reagent blanks that have been retained at the time the reagents were first used in order to determine if contamination or interferences are due to impurities in the reagents. If this is the case, the reagent batch will be discarded and new reagents from fresh containers will be used. If the reagents appear to be sufficiently pure, the cleanliness in the laboratory will be inspected and reinforced to establish if the source of the problem may have been contamination of the apparatus. The data associated with the blank will be reviewed. If the analytes detected in the method blank are detected in the samples, the results reported for that analyte will be flagged.

9.2.6.2 Laboratory Method Blank Exceeds Quantitation Limit

When the laboratory method blank exceeds the quantitation limit, the QA/QC Officer will immediately notify the responsible analyst. Once again, the analyst will check the reagents and apparatus for potential contamination. If reagents are contaminated, the existing batch will be rejected and a fresh batch from a new container will be prepared. If the problem arose from the apparatus, whether glassware or instrumental, the problem will be corrected by the analyst and/or extraction technician. The corrective action will be documented before further analyses can be undertaken. The analyst will then notify the QA/QC Officer of the corrective action. The Sevenson Project Manager, CQCSM, and/or Project Chemist will be kept abreast of the situation via DNF.

The data associated with the failed method blank will be rejected. The samples will be re-extracted and reanalyzed to produce acceptable data. However, in instances where the analyte found in the blank is not detected or detected below the quantitation limit in the samples associated with the blank, the data may be accepted. If re-extraction or reanalysis of the sample is not an option (e.g., sample holding time is exceeded or not enough sample available), the sample data will be flagged using the "B" data qualifier, which indicates that the analyte was found in the associated blank sample as well as in the Site sample.

9.2.6.3 Laboratory Control Sample Exhibits Recoveries Outside the Acceptable Limits

The laboratory will utilize the following steps to determine the corrective action requirements for LCS recoveries outside of the acceptance limits as follows:

- If the laboratory control sample recoveries do not meet the acceptance criteria and the sample results are reported as not detected (i.e., below the method quantitation limit), the laboratory will not perform further corrective actions if the number of sporadic marginal failures allowed by the *QSM* (DOD, 2006) are not exceeded.
- If the laboratory control sample recoveries do not meet the acceptance criteria and the sample results are reported as not detected (i.e., below the method quantitation limit), the laboratory will perform further corrective actions if the number of sporadic marginal failures allowed by the *QSM* (DOD, 2006) is exceeded. The Sevenson Project Manager, CQCSM, and/or Project Chemist will be notified of the problem by a DNF.

- If the laboratory control sample recoveries do not meet the acceptance criteria and the sample results are detected above the method quantitation limit, the laboratory will perform corrective actions even if the number of sporadic marginal failures allowed by the *QSM* (DOD, 2006) is not exceeded. The Sevenson Project Manager, CQCSM, and/or Project Chemist will be notified of the problem by a DNF.

Corrective actions performed by the laboratory for the scenarios outlined above include re-preparation and reanalysis of the LCS sample and the associated field samples. Before repeating the re-preparation of the samples, the calibration of the instrument will be checked by analyzing a continuing calibration check standard. If the instrument is within calibration, the samples will be re-prepared and reanalyzed. If the instrument calibration has drifted, recalibration will be performed and the samples will be reanalyzed.

9.2.6.4 Surrogate Compound Recoveries Outside the Acceptance Limits

When the recoveries of the surrogate compounds are outside the acceptance limits, but the laboratory spiked blank is within acceptable limits, the apparent poor or enhanced recovery may be due to matrix effect. The sample exhibiting the unacceptable recovery may be re-prepared or reanalyzed within appropriate holding times. If the same phenomenon is observed, it will be assumed that the failure to meet recovery criteria was in fact a matrix effect. This information will be included in the analytical results report and the original data will be reported. The unacceptable surrogate recovery will be flagged using the "#" qualifier.

If, upon reanalysis, the recovery of the surrogate falls within acceptable limits, the results of the reanalysis will be reported and the original analysis results rejected due to a potential procedural problem.

In some instances, it may be obvious from the data produced or from the observations made during the preparation process that the sample matrix is causing the unacceptable recoveries. In these cases, the sample will not be re-prepared or reanalyzed. The observations made will be included in the case narrative of analytical result report and the unacceptable surrogate recovery will be flagged using the "#" qualifier.

If the surrogate recovery in a method blank or reference sample is outside the acceptance limits, but the analytes in the reference sample are within acceptable limits, the analyst may need to analyze the surrogate standard solution to check for degradation or contamination. If the standard solution is determined to be the

problem, the analyst will immediately prepare a new standard and the affected samples will be re-extracted and reanalyzed. It is also possible that the calibration of the surrogate compound has drifted, in which case the analyst should re-calibrate the system, and reanalyze the affected samples.

Sevenson's Project Manager, CQCSM, and/or Project Chemist will be notified of any surrogate compound recovery problems via DNF.

9.2.6.5 Matrix Spikes Exhibit Recoveries Outside the Acceptable Limits

When recoveries of spiked analytes from a matrix spike sample analysis are outside the acceptance limits, the apparent poor or enhanced recovery may be due to matrix effects. The matrix spike sample will be re-prepared and reanalyzed to assess this possibility. If the same phenomenon is observed with the re-prepared sample, it will be assumed that the failure to meet recovery criteria was in fact a matrix effect. This information will be included in the case narrative of the analytical result report and the results of both the original and re-prepared sample will be reported. The unacceptable matrix spike sample recoveries will be flagged with the "G" qualifier if the recovery is greater than the upper quality control recovery limit, or the "L" qualifier if the recovery is less than the lower quality control recovery limit.

If upon reanalysis the recovery of the spiked analytes falls within acceptable limits, the results of the reanalysis will be reported and the original analysis results rejected due to a potential procedural problem.

In some instances, it may be obvious from the data produced or from observations made during the preparation process that the samples matrix is causing the unacceptable recoveries. In these cases, the sample will not be re-prepared or reanalyzed and the observations made will be included in the case narrative of the analytical result report. Again, the unacceptable recoveries will be flagged with the "G" qualifier if the recovery is greater than the upper quality control recovery limit, or the "L" qualifier if the recovery is less than the lower quality control recovery limit.

Notifications of matrix spike recoveries outside of the acceptable recovery limits will be made to the Sevenson Project Manager, CQCSM, and/or Project Chemist via a DNF.

9.2.6.6 Relative Percent Differences from MS/MSD Samples or Duplicate Samples Analysis Outside the Acceptance Limits

When the RPD of an analyte from matrix spike/matrix spike duplicate sample analysis is outside the acceptance limits, the MS/MSD or duplicate samples will be re-prepared and reanalyzed to determine if the unacceptable RPD is due to sample matrix. If the RPD for the analyte is again observed to be outside the acceptance limit of the re-prepared samples, it will be assumed that the failure to meet RPD criteria was due to matrix effects. This information will be forwarded to Sevenson personnel via a DNF and included in the case narrative of the analytical result report and the results of both the original and re-prepared sample analyses will be reported. The unacceptable RPD will be flagged with the "#" qualifier.

If upon reanalysis, the RPD of the analytes fall within acceptable limits, the results of the reanalysis will be reported and the original analysis results rejected due to a potential procedural problem.

9.2.6.7 Sample Analyte Concentration Exceeds Calibration Range

If the concentration of analyte exceeds the calibration range for a particular analysis, the sample or sample extract will be reanalyzed at an appropriate dilution so that the analyte concentration in the diluted analysis is within calibration range. The results of both the undiluted analysis and the dilution analysis will be reported for the sample. The detection limit(s) reported for the affected sample(s) will be increase according to the required dilution.

9.2.7 Calculation Errors

Reports will be reissued if calculation and/or reporting errors are noted with any data package. The case narrative will clearly state the reason(s) for reissuance of a report.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data review procedures are a set of computerized and manual checks applied at appropriate levels of the measurement process. Data review begins with the reduction (processing) of data, continues through verification of the data, and reporting of analytical results. Calculations are checked from the raw data to the final value prior to reporting results for each group of samples. The analyst who obtained the data can perform data reduction. Data verification starts with the analyst to assure the work is done correctly the first time. Data verification continues with review by a second reviewer who verifies that data reduction has been correctly performed and that the reported analytical results correspond to the data acquired and processed.

10.1 Data Reduction and Initial Verification

More than one analyst, depending upon the analytical method employed or laboratory policy, can perform data reduction and initial verification. Different analysts can review the preparation and analytical data independently. In these instances, each item may not be applicable to the subset of the data verified or an item may be applicable in both instances. It is the responsibility of the analyst to ensure that the verification of data in his or her area is complete. The data reduction and initial verification process must ensure that:

- Sample preparation information is correct and complete including documentation of standard identification, solvent lot numbers, sample amounts, etc.
- Analysis information is correct and complete including proper identification of analysis output (charts, chromatograms, mass spectra, etc.).
- Analytical results are correct and complete including calculation or verification of instrument calibration, QC results, and qualitative and quantitative sample results.
- The appropriate SOP has been followed and is identified in the project records.
- Proper documentation procedures have been followed.
- All non-conformances have been documented and reported.
- Internal COC is complete and documented, if applicable.
- Special sample preparation and analytical requirements have been met.

An analyst will process data in one of the following ways:

- Direct acquisition and processing of raw data by a computer.
- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets.
- Input of raw data for computer processing.

If an analyst manually processes data, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors, dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, they may be attached to the data sheets.

For data input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed must be clearly identified.

If data is directly acquired from instrumentation and processed, the analyst must verify that the following are correct:

- Project and sample numbers.
- Calibration constants and response factors (RF).
- Units.
- Numerical values used for reporting limits.

Analysis-specific calculations for methods are provided in the method SOP. In cases where computers perform the calculations, software must be validated or verified before it is used to process data.

The data reduction is documented, signed and dated by the analyst completing the process. Initial verification of the data reduction by the same analyst is documented on a data validation checklist, signed and dated by the analyst.

10.2 Data Verification

Following the completion of the initial verification by the analyst performing the data reduction, an experienced peer, technical person, or supervisor performs a systematic second-level verification of the data.

The second level reviewer examines the data signed by the analyst. This review includes an evaluation of all items required in the raw data package. Any exceptions noted by the analyst must be reviewed. Included in this review is an assessment of the acceptability of the data with respect to:

- Adherences of the procedure used to the requested analytical method SOP.
- Correctness of numerical input when computer programs are used (checked randomly).
- Numerical correctness of calculations and formulas (checked randomly).
- Correct interpretation of chromatograms, mass spectra, etc.
- Acceptability of QC data.
- Documentation that instrument was operating according to method specifications (calibrations, performance checks, etc.).
- Documentation of dilution factors, standard concentrations, etc.

This review also serves as verification that the process the analyst has followed is correct in regard to the following:

- The analytical procedure follows the methods and specific instructions given on the project file.
- Non-conforming events have been addressed by corrective action as defined on a non-conformance memo.
- Relevant comments about sample or analysis problems are clearly stated.
- Valid interpretations have been made during the examination of the data and the review comments of the initial reviewer are correct.
- The package contains all of the necessary documentation for data review and report production, and results are reported in a manner consistent with the method used for preparation of data reports.

The specific items covered in the second stage of data verification may vary according to the analytical method, but this review of the data must be a documented list with the signature of the person performing the review.

10.3 Completeness Verification

The Laboratory Project Manager performs a third-level review. This review is required before results are submitted. This review serves to verify the completeness of the data report and to ensure that client project requirements are met for the analyses performed. The items to be reviewed are:

- Analysis results are present for every sample in the analytical batch or sample delivery group.
- Every parameter of target compound requested is reported with either a value or reporting limit.
- The correct units and correct number of significant figures are utilized.
- If specific data reporting forms were requested, all forms are present and are completed correctly.
- All non-conformances and data evaluation statements that impact the data quality are accompanied by clearly expressed comments from the laboratory.
- The final report is legible, contains all the supporting documentation required by the project, and is in either the standard format or in the client-required format.

A case narrative to accompany the final report will be prepared by laboratory project management. This narrative will include relevant comments from the earlier reviews as determined by the laboratory Project Manager.

10.4 Data Reports

10.4.1 Laboratory Analytical Data Reports

Data packages for off-site analysis shall be performed at USEPA Level III. Data packages at USEPA Level III shall be prepared in accordance to the requirements of EM 200-1-6 (October 1997) and include the following:

- **Cover Sheet.** The cover sheet should specify the name and address of the laboratory, contract number, project name, site location, statement of authenticity, and official signature of release.

- **Case Narrative.** A case narrative should be included which outlines any problems encountered during sample analysis. The case narrative should also list all methods used and contain a table correlating field sample numbers and laboratory sample numbers. Samples that were received but not

analyzed should also be identified. Extractions or analyses performed outside of holding times should be noted. The case narrative should identify all data qualifiers or flags. Deviations of QC sample results from laboratory acceptance criteria should be noted and associated corrective actions taken by the laboratory should be addressed. Any other factors that could affect the sample results (e.g., air bubbles in VOC sample vials; inappropriate sample temperature, pH, container type, or volume; etc.) should be discussed.

- **Analytical Results.** The results for each sample should contain the following information at a minimum:

    1. Project name and unique ID number.
    2. Field sample ID number as written on custody form.
    3. Laboratory name and location (city and state).
    4. Laboratory sample ID number.
    5. Date sample collected.
    6. Date sample received.
    7. Date sample extracted or prepared.
    8. Date sample analyzed.
    9. Analysis time when holding time limit is less than 48 hours.
    10. Method number for all preparation and cleanup procedures.
    11. Analysis procedure including method numbers.
    12. Analyte or parameter.
    13. Detection limits adjusted for sample-specific factors (e.g., aliquot size, dilution or concentration factors).
    14. Method quantitation limits.
    15. Analytical results with the correct number of significant figures.
    16. Concentration units.
    17. Dilution factor.
    18. Matrix (water, soil, oil, etc.).

- **Lower Reporting Limit.** The laboratory may use a reporting limit expressed in terms of method detection limit, method quantitation limit, regulatory action level, or project-specific threshold limit. If

the non-detect "ND", "U", "<", or other lower limit reporting convention is used, then these terms must also be defined.

- **Sample Documentation.** Original chain of custody record, shipping documents, and sample cooler receipt forms should be attached to each data package.

- **QA/QC Information.** The minimum data package must include internal laboratory QA/QC data with their respective acceptance criteria. The data package should also include the laboratory's method quantitation limits. Method QC data include all spike recoveries, including surrogate spike recoveries; all measures of precision, including relative percent difference; and all control limits for accuracy and precision. This would include laboratory performance information such as results for method blanks, recoveries for laboratory control sample and laboratory control sample duplicate (LCSD), RPD for LCS/LCSD pairs, and recoveries for QC sample surrogate; and matrix-specific information such as sample duplicate RPDs, MS and MSD recoveries, MS/MSD RPDs, and field sample surrogate recoveries. Any deviations from the control limits should be noted.

Any analytical results communicated verbally or by facsimile must be reviewed and approved prior to the communication. These results must be of the same quality as the hard copy report.

It is the responsibility of the laboratory to provide a reporting system that ensures that any problems associated with an analysis are properly documented on a non-conformance memo, communicated to the appropriate off-site laboratory associates, and addressed appropriately in the data report.

Raw data will be available for later inspection, and maintained in the job file. Results will be sent by facsimile and/or electronically to the site the day that the sample results are due and hard copy results will be mailed to the Sevenson Project Chemist for data review within 21 days of the validated time of sample receipt by the laboratory.

10.4.2 Quality Control Summary Report

A QCSR will be completed for each remedial area (i.e., cluster) once all applicable data has been received from the laboratory. Section 8.3 of the FSP contains specifics concerning the contents of the QCSR.

10.4.3 Analytical Services Tracking (ANSET)

Per the requirements of the Superfund program, analytical samples will be tracked using the Analytical Services Tracking (ANSET) system. Sevenson will complete the form provided by USEPA Region II on a monthly basis. The form will be completed by the 5th of the month following the month that sampled were collected (e.g., the report for samples collected during January is required to be submitted by the 5th of February). The submission will be sent to USEPA Region II (Michael.adly@epamail.epa.gov). USEPA Region II will complete the submission of the information to USEPA Headquarters.

10.5 Data Quality Assessment

A systematic process for data assessment and review will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often the result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data review will be performed to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach is consistent with the data quality objectives for this project, with the analytical methods, and for determining contaminants of concern and calculating risk.

Data review will be accomplished by comparing the contents of the laboratory data package and QA/QC results to requirements contained in the analytical methods. The Sevenson Project Chemist will be responsible for overseeing these activities. The review will be performed by reviewing the reported sample and QA/QC results in comparison to the requirements provided in *Kansas City District Data Quality Evaluation Guidance* (USACE, 2003). Sevenson will conduct a systematic review of the analytical data and QA/QC sample results for compliance with the established guidance based on the following criteria:

- Chain-of-custody.

- Preservation.
- Requested analyses.
- Holding time.
- Blanks.
- LCS/LCSD percent recoveries and RPDs.
- Blind field QC duplicates.
- Surrogate results.
- MS/MSD percent recoveries and RPDs.
- Sample quantitation limits.

All project data will be evaluated on these categories and qualified as per the outcome of the review. The Project Chemist may use professional judgment during the review process whereby data qualifiers may be assigned differently from those required following a literal interpretation of the Guidance. Such circumstances will be clearly and completely documented in the QCSR. Information gathered during this evaluation process will be summarized on a Data Evaluation Checklist. A copy of this checklist is included in Appendix A and the completed checklist will be included with the laboratory data report(s) included as an appendix to the QCSR.

This data review will indicate that data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable due to out-of-control QC results.

Each data assessment category and associated qualification requirements are summarized below:

- **Chain-of-Custody.** Determine if the chain-of-custody form is present, properly completed, and properly signed. In addition, inspect the sample receipt checklists to determine if the laboratory noted any problems upon receipt of the sample cooler. Sample results may be rejected if the identity of any samples is in doubt.

- **Preservation.** Determine if sample integrity has been maintained from the time of sample collection through analysis. Samples that were improperly preserved or received outside of the required temperature range may be rejected.

- **Requested Analyses.** Determine if the chain-of-custody-requested analyses were performed by the requested methods.

- **Holding Times.** Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. The evaluation of holding time is essential for establishing sample integrity and representativeness. Concerns regarding chemical, physical, or biochemical alteration of analyte concentrations can be eliminated through this evaluation. If a holding time is missed, associated sample results will be rejected.

- **Blanks.** The assessment of blank data is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks apply to any blank associated with the samples, including rinsate blanks, trip blanks, and method blanks. Field sample results will be qualified as undetected ("U" code) if the concentration in the sample is less than five times in any associated blank, reported with the same detection limit. For common laboratory compounds such as methylene chloride, acetone, 2-butanone, and common phthalate esters, results will be qualified as undetected if the sample concentration is less than ten times the concentration in any associated blank, reported with the same detection limit. Other than assigning qualifiers, analytical results will not be altered due to blank contamination.

- **Laboratory Control Samples.** The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based on a measurement of process control during each sample analysis. Sample results will be qualified per the requirements set forth in the USACE guidance (USACE, 2003).

- **Blind Quality Control Duplicate Samples.** The degree of agreement between field duplicate samples is to be used in conjunction with other QC results as an aid in determining the overall quality of the data. For all analyses in water matrices, data will be considered in agreement if the results are within a factor of two of each other. Data between a factor of two and three of each other will be considered a minor discrepancy and data greater than a factor of three should be considered a major discrepancy.

- **Surrogate Recovery.** System compounds are added to every sample, blank, matrix spike, matrix spike duplicate, and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. For surrogate recoveries outside of the laboratory limits, sample results will be qualified per the requirements set forth in the USACE guidance (USACE, 2003).

- **Matrix Spike/Matrix Spike Duplicates.** Sample results will be qualified per the requirements set forth in the USACE guidance (USACE, 2003).

- **Sample Quantitation Limits.** The laboratory must supply a reason for any quantitation limits reported outside of the required limits. No further action is necessary if the cause is uncorrectable. Resample and reanalysis may be required if the cause can be corrected.

12.0 PERFORMANCE AND SYSTEM AUDITS

Field audits are discussed in Section 7.0 of the FSP and are not repeated here. Sevenson will utilize the three-phase process to assess performance for each definable work element.

Performance/system audits will be conducted at fixed intervals to independently assess the laboratory's ability to produce accurate quantitative analytical data within acceptable control limits. Two mechanisms will be employed to conduct these audits: external and internal performance/system audits.

12.1 External Performance/System Audits

Performance audit samples, supplied by the USACE, NJDEP, and NELAP will be routinely analyzed by the laboratory. The results of these analyses will be reported to the respective agencies and will provide the basis for ongoing laboratory certification. Moreover, onsite system audits may be conducted by any of these government agencies at their discretion. The laboratory will be responsible for scheduling and coordinating external system audits and also for reviewing data from performance audit samples, so that corrective actions, if any, may be implemented as soon as possible.

The Sevenson Chemical Quality Control Manager will also perform system audits via data review. In addition, he may conduct quarterly, onsite system audits of the overall chemical data quality activities; this audit will consist of a review of sample collection, decontamination, and documentation procedures. Summary reports will then be prepared; any deficiencies and/or deviations will be documented and addressed on a formal basis. Checklists to be used during onsite system audits are included in Appendix A.

12.2 Internal Performance/System Audits

The laboratory's quality assurance personnel will conduct performance and system audits regularly. The purpose of this routine monitoring is to ensure that quality data is produced, and if not, to supply the impetus for internal corrective actions. This monitoring will take place in two phases: system audits and performance audits.

The laboratory will conduct periodic in-house system or surveillance audits on a bimonthly basis during which overall laboratory practices, adherence to laboratory standard operating procedures and project specifications, and completeness of analytical data packages will be evaluated. Any deficiencies and/or deviations identified during these system audit activities will be documented and rectified. In addition, the laboratory will maintain records of these procedural audits.

The laboratory will also initiate internal performance evaluation samples. These will be introduced into the laboratory system as blind samples. In this way, the laboratory may monitor the success of their analytical performance of all project analytical methods on a quantitative basis. Once again, the laboratory will address any analytical method nonconformances.

13.0 REFERENCES

Chemical Quality Assurance for HTRW Projects (EM 200-1-6), USACE, October 1997.

Guidance for the Data Quality Objectives Process, QA/G-4, EPA/600/R-96-005, USEPA, August 2000.

Kansas City District Data Quality Evaluation Guidance, USACE, August 2003.

Project Specifications for Cornell-Dubilier Electronics Superfund Site – OU2, USACE, June 2006.

Quality Systems Manual for Environmental Laboratories, DOD, January 2006.

Requirements for the Preparation of Sampling and Analysis Plans (EM 200-1-3), USACE, February 2001.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW-846, Final Update III, December 1996.